Semiotics in Action: The Pragmatic Level

"Contemporary ways and structures on the pragmatic level of semiotic" was the title suggested by Prof. Herbert Stachowiak, the initiator and editor of the series. I understood it as an invitation to account for contemporary significant directions (a task of the yet not written history of contemporary semiotics) and to show the methodological elements characteristic of these diverse tendencies. While I do not shy away from these expectations, I have to acknowledge that the main purpose of this study is to put in *perspective* the contemporary ways and structures on the pragmatic level of semiotic. Privileged to account for such developments, I also take it as an implicit mission to challenge some of the ways the pragmatic level has been understood and applied, as well as the structures within which this has come about. One of the intentions is to reintegrate what became known, after Morris *et al,* as the pragmatic level of semiotics and to remove it from psychology (where it landed again despite Peirce's initial warning), and to place it back in the semiotic from whence it originated, in order to realign it with the foundational Peircean philosophy from which it derived and outside of which it makes little sense, if any. To a certain extent, my previous contribution *Pragmatics in the Semiotic Frame* (Nadin, 1987) can be seen as the foundation for the views expressed here. It is not for the sake of quoting myself—a form of self-indulgence widespread in academia—that I will refer to this text, but for avoiding unnecessary repetition.

The plan I intend to pursue is straightforward: to define the semiotic frame ("Premise") within which a sensible, and hopefully coherent, discussion of the pragmatic level is possible, and which is also broad enough to make possible explanations of directions for future developments. Then I shall provide a *tour d'horizon* of some (and only some, since to exhaust the subject would require a book) contemporary approaches that can be identified beforehand as the behaviorist pragmatic and the mentalist and functional views. (These accounts are offered in the sections "Journey In and Around the Semiosphere," "On the Reality of the Mind," and "Sign and Memory.") The well-versed reader might wonder whether these directions are not too close to the way we account today for philosophy and its contemporary ways. The fundamental philosophic attitudes that my account takes into consideration are reflected in semiotics, because semiotics requires a philosophic foundation even if it does not always use philosophic discourse.

In view of the implications semiotics has in current cognitive studies and their artificial intelligence technological embodiments, I will continue ("The Inference Engine") by introducing the idea of a semiotic stage of human development that corresponds to the post-industrial society—often labeled *postmodern*. The reader can already notice that from among the various aspects of the pragmatic level, I selected one that I consider of major importance today, and which can be critical for the evaluation of the relevance of semiotics in general. My own concept, developed in years of interaction with many distinguished colleagues and tested in various intellectual contexts of pragmatic relevance, is not to be seen as the end of the study, but as its propaedeutic.

1. Premise

Exploring whatever constitutes the contemporary body of work, I came to suspect that the relative failure of semioticians to ascertain the discipline as a scientific or humanistic entity on its own merits—not everybody will agree with this assessment—is due to two failings: to define its basic presuppositions and to operate on the pragmatic level, where merits and shortcomings are bound to be more evident than on any other level. The arguments on which this understanding is based will result in and from the course of this study. They are related to the development of pragmatic activity, as well as to the methods on which this activity seems to be based. The inroads that semioticians have made are mainly at the syntactic level.

The premise of my research on contemporary pragmatics defined in a semiotic framework is that semiotics can be loosely characterized as a way of revealing how our knowledge of the world (both physical and spiritual) is constituted, and how our awareness of the process is reflected in the dynamics of various semiotic systems or directions. More strictly, as the "quasi necessary or formal doctrine of signs," (CP 3.271, 1931-1958) it deals with what became known as modes of rational conduct. Noth's (1985) definition seems to reflect our better understanding of the role this discipline can assume today: "Semiotics is the science of signs." In practice, I have found this formula vulnerable, if not vacuous. Locke, in 1690, translated the medieval expression, *doctrina signorum,* which, in the parlance of the Schoolmen, as well as of Locke and later of Peirce, acknowledged that the true burden of semiotics is to ascertain the means whereby knowledge is acquired, increased, and passed on ("communicated"). In brief, semiotics is an evolving theory of mind, which, since the late 1950's, has been re-described and declared to be the subject matter of the newly labeled "cognitive sciences." It is also useful to think of semiotics as a teaching maneuver combined with a learning stratagem (Sebeok, 1986).

Reasoning (today mimicked in various computational models, some originating, ironically, from previous attempts to build mechanical contraptions conceived for performing logical or arithmetic operations) is *in signs* and *through signs*. Without an adequate sign definition, this rather strong statement means nothing. With confused or arbitrary definitions (like many used in our days), it can turn into a rather misleading and untenable statement. However, in order to find out what kind of a sign concept would justify the semiotic approach, we must, I submit, question again and again the very foundation of a sign-oriented discipline and come to realize that this foundation is itself pragmatic. Looking at the process of reasoning in reverse, i.e., back from results that we share either as scientific principles or philosophic truisms, to the process through which they were derived—and which semioticians call *semioses*—we should understand that our hypotheses are continuously tested. We are part of the *sui generis* experiment through which semiotics itself has repeatedly come into being during the history of human thinking. It vanished again and again, because the promises made, at junctures such as Aristotle, St. Augustine, Locke, Giordano Bruno, Leibniz, Baumgarten, Poinsot, etc., went far beyond the actual knowledge it rendered possible or the explanations semioticians (bona fide or self-declared) thought they could deliver.

The facts of semiotics are testimonies of experience, not experience as such. These testimonies are signs and their most immediate function is to represent. Some representations are communicated (in forms such as theories, explanations, hypotheses, proofs, etc.). Some are perfected until they reach a level of expression which justifies them in themselves (works of art, games, formalisms, etc.). At first impression, signs appear to be subjective, random, and arbitrary. Many of those who have tried their luck in semiotics (Pelc talked about the "waves of immigrants" flooding a science in periods of its prosperity, "attracted by prospects of new possibilities," 1984) never realized that signs are not really arbitrary. Some self-proclaimed semioticians and some "immigrant" semioticians are like people who fail to understand that numbers or, more generally, mathematical notations are not at all arbitrary, that colors, shapes, and musical tones are not arbitrary, that languages are not arbitrary. Signs (in particular signs used in mathematics and logic), colors, tones, and shapes occurring in our technical or artistic activity are determined by the nature of our own existence, by the coherence which we project upon experiences in which we involve ourselves or which we design, trigger, and analyze.

There is a physical reality to any sign (accepted without exception in every know semiotics), and there is a mental process associated to it. Sometimes the balance is inclined towards the physicality of signs, other times towards the mental aspects. In recent years, ways in which we generate and use information became quite attractive. Within the realm of information, a compromise between mere physicality and sheer mentalism seems to be sought. I do not try to offer this as a complete description of the ways in which the pragmatic dimension of the sign is conceived, but as a kind of explanation of the types I consider characteristic (and *why*) for the subject covered here. Within each of the directions mentioned, many distinctions (epistemological logical, or even ideological in nature, to name a few more relevant) become evident once we more closely examine their basic assumptions. But I dare say that on a fundamental level, nominalism and realism continue to be the "colors" of the "parties" involved. This may sound strange to some contemporary readers, especially those who could not come to understand that the modern foundation of pragmatism reactivated the century-old dispute between those accepting only the singulars and rejecting the reality of generals, and others claiming that science is a matter of the reality of generality and universals. Today this is no longer a scholastic issue, rather it pertains to one of the most advanced technologies (such as artificial intelligence).

2. Journey in and around the semiosphere

Max Fisch (1969) said, "There have been many revolts against Descartes." Pragmatism, as an intrinsic part of Peirce's semiotics, can probably be seen as one of the most radical of these never-ending attacks on one of the most conspicuous constitutive elements of what is called western civilization. From a certain vantage point, these revolts can be seen as the continuation of the debate between nominalism and realism. By an ironic twist, which makes the object of this section (and which did not go unnoticed for too long, see Notes, 1), the basic position expressed in Peirce's sign theory and in the doctrine of *pragmati(ci)sm* was reversed in Charles Morris' (1938) division of syntactics, semantics, and pragmatics. For a number of reasons, this upside down pragmatism dominated the modern new beginning of semiotics and has exercised a strong influence even in our days.

The spiritual journey of what is known as logical positivism (and all its future directions and denominations) remains connected to some of the places where major ideas were expounded, working hypotheses defended and results published and argued. In the move from the German-speaking Middle Europe (Vienna is definitely a station of renown, so is Prague, where in addition to local scholars, the Russian formalists congregated for a while and established a rather important semiotic center) to England, and finally to the American continent, the group exercised an impressive, though not always consistent, intellectual influence. The ideal of a Unified Science, *Einheitswissenschaft,* and even Universal Science, for which semiotics can serve as an instrument (or be that universal science) determined others in addition to Morris and Carnap to research the role of signs in gaining (and verifying) knowledge. They were looking, as Descartes did at his time, for fundamental concepts, elementary experiences, and the possibility of applying constructive principles within gnoseology and epistemology. When Morris took over Peirce's semiotic (especially the pragmatic concepts, in a strange selective manner and never really correctly), he must have hoped that the realistic foundation could simply be ignored, or he read only that part of Peirce's work which was still of nominalist extraction. Although we know what was already published from Peirce's studies in the years when Morris wrote his compilations, we cannot be sure that Morris read everything, or that he was able to make up from fragments (constituting the *Collected Papers* edited by Weiss and Hartshorne) the image of a comprehensive philosophic system. We can say, however, that changes made when he took over a terminology, which was not his and for which he did not credit anybody, are characteristic of a nominalist. After all, aren't these concepts only names (Notes, 2)? We know now that names participate in knowledge, too, and that by no accident Peirce worked on *Ethics of terminology* (Notes, 3*)* exactly after realizing the role it plays in our attempt to build theories or to explain concepts. Transforming the interpretant into an interpreter—a change critical for the very thought of pragmatism—redefining semiosis, redefining the *icon, index, symbol,* etc., are not exercises in composition but implicit philosophic arguments, too often unnoticed by those involving themselves and using them through secondary sources. Nominalist thought is, simply put, reducible to the following sequence: Names mean nothing, only the individual is important, so pragmatism is actually what people ("interpreter") do with signs. Peirce's obsession with defending his definition (at the price of coining another term) and maintaining the fundamental philosophic attitude of a nominalist converted to scholastic realism was not an issue for Morris. With Morris and his followers, pragmatism became a form of behaviorism with a strong logical-positivist tone.

These preliminary remarks are necessary because one of the dominant ways the pragmatic level of semiotics was and is realized is behavioristic. The mystification is not unimportant. Peirce almost prophetically wrote about the implications.

> We cannot begin with complete doubt. We must begin with all the prejudices which we actually have when we enter upon the study of philosophy. These prejudices are not to be dispelled by a maxim, for they are things which it does not occur to us can be questioned. Hence this initial skepticism will be mere self-deception, and not real doubt; and no one who follows the Cartesian method will ever be satisfied until he has formally recovered all those beliefs which in form he has given up.[...] A person may, it is true, in the course of his studies, find reason to doubt what he began by believing; but in that case he doubts because he has a positive reason for it, and not on account of the Cartesian maxim. Let us not pretend to doubt in philosophy what we do not doubt in our hearts" (CP, 5.265, 1, 1931-58).

Now let us examine how this particular kind of pragmatic concept is applied. From among the many impressive scholarly formations in which the behaviorist pragmatic thought is pursued, the one represented by what is known as the Soviet School deserves special attention since it is symptomatic for the entire direction here analyzed. It also deserves attention due to the significance of the work produced and the influence it exercises (not only in the sphere of influence of the country from which it originates and in which it plays a rather important intellectual, and not only intellectual, role).

The distinction between the semiotics of the sign and the semiotics of language as a sign system serves as initial identifier for Yuri Lotman and Boris Uspenskij (1984) in their effort to introduce a comprehensive semiotic concept and to apply to in the analysis of such complex phenomena as those belonging to and defining culture. Although the references the two give in the course of the argument (Notes, 4) are *stricto sensu* wrong, the thought deserves closer examination. As we have already learned from Lotman (Notes, 5), there is a pragmatic dimension in reconstructing extratextual empirical reality by means of the text. Now he and Uspenskij develop the idea by saying that culture can be seen as a "system that stands between man (as a social unit) and the reality surrounding him, that is, as a mechanism for processing and organizing the information which comes to him from the outside world." The next step in defining a comprehensive semiotic entity follows almost syllogistically. "Just as life on earth forms a biosphere, the single mechanism of interdependent dynamic life-structures, so the semiotic phenomena come into the researcher's view not as separate isolated phenomena, but forming a vast picture of a single semiosphere," (Lotman & Uspenskij, 1984). Jonathan Culler (Notes, 6) expounded a similar idea, mentioning that Cassirer, Whitehead, and Langer asserted the primacy of what they called the symbolic dimension of human experience.

Several remarks about this concept are necessary before we continue the analysis; but in order to make them, we have first to figure out what the semiosphere actually contains. "The semiosphere, if pictured in the momentary film-still of a synchronic cross section would include in itself all the totality of semiotic acts, from the signals of animals to the verses of poets and the call-signs of artificial satellites," Lotman & Uspenskij, 1984). It is quite clear that Lotman and Uspenskij continue Morris' line of thought, suggesting a typical stimulus-reaction model (identified even in the premise represented by the integration of signals of animals in the category of semiotic acts). The nominalist foundation derives from the very strong referential quality of the semiotic universe described, as well as from the psychological overtones reflected in the type of pragmatic possible within the semiosphere. The authors, and almost all their colleagues in the school of thought they belong to, candidly make known the premise of the pragmatic function relevant to the semiosphere and talk about culture as a semiotic system which "regulates human behavior" and also "determines how he (man) models the world," (Lotman & Uspenskij, 1984). It is a sophisticated approach within which the authors try to integrate information processing and organization of information, communication, and functional interdependence of the various constitutive parts of culture, all with the aim of suggesting a "semiotic physiology." By this they understand "a study of the functional connection between the different languages in the single functioning whole," (of culture, Lotman & Uspenskij, 1984). Some strikingly sensible observations deserve and received the attention of the semiotic community. They came along the line of a nuanced discussion of semiotic diversity and of the factor of cultural time.

It is worth mentioning that almost all the Soviet semiotics (in which case the names Eisenstein, Ivanov, Bachtin, etc. should be added to those of Lotman and Uspenskij) devoted attention to culture in its various forms and produced some of the most intriguing cultural essays of our time, especially after the philosophic discussion of the distinction between culture and civilization ended so inconclusively in the writings of Spengler and his followers. The effort to apply a sign oriented method did not succeed without difficulty, since the ideological aspects of the method of research quite often disqualified anything which did not follow the prescription of the dialectic and historic materialism (itself a basically nominalist philosophy). Culler describes quite accurately the limits within which semiotic work can be performed under these circumstances: "...a

Marxist might see his task as interpreting social phenomena as signs of the events of economic history which caused them," (Notes, 7).

The pragmatics of semiotics, as we read it here, coming from a very rigidly prescribed philosophic universe, is quite impressive. The vocabulary used can be misleading; it is a language game of sorts in a regulated environment in which the semiosis cannot really be infinite. (Actually, it is not infinite, primarily because of the behaviorist premise that reduces the sign to a stimulus function, and the reaction to a limited "effect.") Within the culture which semioticians brilliantly analyzed, the use of semiotics was interpreted by many as an act of intellectual resistance. The observer and the observed phenomena constitute a unity in view of the meaning of the endeavor (Notes, 8). Semiotics explains past pragmatic relations in order to project understanding of current pragmatic aspects. By no accident, some of the most intriguing contemporary works in semiotics and the pragmatic implications of semiotic action for a long time came from the Soviet Union, from East Germany, Poland, Hungary and similar countries. The social-political implications of this fact cannot be ignored (however, they belong to a different object of study; Notes, 9). But what identifies the entire corpus of works to which I refer is its almost never challenged behavioristic tone. The utopian, (in many people's minds) Marxist project of a new human subject involves a strong behavioristic component, present not only in semiotics, but also in psychology, philosophy, economics, etc. The teleological nature of this society is reflected in the teleological nature of the pragmatic concept it makes possible (and even requires). Although dialectics is the official method, rhetoric is the real method, an uninterrupted semiosis of persuasion. The world (social, artistic, or of ideas, etc.) has to be changed. Or the world has to be explained in order to explain historic laws, to suggest ways to implement programs originating from the dominant ideology.

A parenthesis should be opened at this juncture: The utopian Marxist project is now subject to evaluation, criticism, and even sheer revision. At the time I started reviewing this text—August 1989, mentioned here because recent events have shown how fast changes of direction can occur—a significant, and surprising by its amplitude, contemporary direction is embodied in the semiotics of *glasnost* and the rhetoric of *perestroika* (both defining pragmatic directions). Related to this are the developments toward plurality (in Poland and Hungary so far), all significant for the departure from the embedded behavioristic dimension of the utopian project now challenged not only theoretically but also in social and political practice. Nevertheless, in the new tendencies (reflected in new policies and new semioses), one can see behind Morris the shadow of Descartes, read through the eyes of Marx and Engels by leaders of a more pragmatic tendency and with a historic confidence not shattered by the acknowledged failure of the system they must now abandon. End of parenthesis.

The semiosphere is a system of rules justified through culture. In the French, semiologically inspired, approach, especially in Barthes' work, the same basic attitude helps in defining the ideological implications of different forms of pragmatics within the semiotic subsystems constituting culture. It is within this school of thought that Freud's psychological analysis penetrated semiologic discourse in order to explain deviations for which more deterministic thought cannot exactly account. Freud's and Jung's symbolic systems play a very important role here, stimulating discussions regarding semiotic codes which went a step ahead of the similar discussions in the Soviet School. Eventually the theme will have to be recuperated, brought (finally) outside this behavioristic frame. To date, a great deal of interesting speculations have been produced within this paradigm and constitute hypotheses which deserve to be challenged and tested. The pragmatic of the sign is defined within the semiosphere like in the dialectic model of the relation between structure and economic basis, but generally with much more richness, more details, more nuances. Feruccio Rossi-Landi (Notes, 10) went so far as to define language as a force of production and continued with a type of analytic discourse typical of Marxist political economy.

The entire direction discussed here is one of brilliant essays, which means it is a semiotic discourse with a pragmatic level situated somehow between the rigorous explanations one would like to receive from a systematic sign approach and rich literary expression. Once the framework is established, demonstrations remarkable in their unexpected ramifications are provided. In his succinct article "On the Origin of Russian Obscenities", Uspenskij (1984) approached the sensitive issue of a "vocabulary of degradation (which) approaches that of religion," (Note 11). The taboo attached to the subject, today as in older times, does not preclude elements of interdisciplinarity: from literary studies, history, and aesthetics, to anthropology. Although at times the reader would hope for a more detailed account (of the *opachivanie,* nocturnal ceremony, aimed at freeing a village from epidemics, or of why an obscene expression was considered "a Jewish word"), the pragmatics evidenced through the text is impressive in its variety of implications. This and a few other articles are instances in which the limits of the behaviorist premise become painfully evident. Other times, the authors operate within the boundaries they set for themselves (an excellent example is Lotman's "The Stage and Painting Code Mechanisms for Cultural Behavior in the Early Nineteenth Century," (Notes, 12). A detailed account of all the themes and results obtained within this pragmatic mode is difficult to give and not very conclusive after all.

Within the semiosphere, to which semiotic action of behaviorist nature belongs, we move from premise to conclusion in ways, which actually contradict the very nature of the pragmatic principle. Signs are reduced to a presemiotic condition (they are after all only signals, some very complex, but designed to function as signals). There is actually no way for a semiotic process (potentially infinite by definition) to take place. All processes are psychological, but against the background of some broader picture, sometimes so broad (the entire culture) that one wonders what it actually means to work within such a broad context as an entire culture. In such cases even the nominalist foundation comes under the pressure of a speculative tendency. These statements should not be misconstrued as a value judgment, but viewed in the frame of a discussion started before and outside this study with the question "Which pragmatism?" and continued with "Why pragmatism?" if the spirit of the method cannot be observed. It is quite surprising to find Descartes' subjectivism, criticized with such fervor by Morris' teachers, revitalized within the boundaries of an approach faithful to the "bible" of objective materialism. The logical contradiction originates in Morris' concept of pragmatism, and it marks the research I refer to in ways probably not anticipated by those who embraced his concept.

The semiosphere, with its memory, includes all the texts ever created, as well as the programs for generating future texts. Articulation of value judgments within this sphere is cumbersome. The unity, almost identity, between the evaluated and the evaluator is an almost insurmountable hindrance. So it becomes necessary to escape, to try a journey around this metaphoric space of semiotic action, or to find a third element which will allow for the sequence of mediations through which the pragmatic level of the sign is achieved. Individual authority, which is the indexical sign of behaviorist systems, has to be replaced with the objectivity of the scientific community, in order to make clarity possible.

The issue is thus the design of the experiment bearing on the truth of a conception: "In short, *cognizability* (in its widest sense) and *being* are not merely metaphysically the same, but are synonymous terms," (CP 5.257). Even the ideas displayed in writings like Lotman's, Uspenskij's, Ivanov's, and others and the attempt to reinstate introspection (cultural, in this case) become disputable. The pragmatic maxim and the logic of abduction that embodies it require continuity of inquiry, testing of hypotheses (implicitly, their testability), and openness. Descartes' system needs the special faculty that explains self-consciousness, because he did not value hypothetical reasoning from known facts. The very possibility of science is in universals, and in this respect "All thought is of the nature of sign," (CP 3.112). The renovated realism, which Peirce argued is required by science, accounts for the relation between reality and the mind. The continuous reexamination of this reality corresponds to the continuous redefinition, actually *reconstitution,* of the mind. As promising as it was, the program represented by the metaphor of the semiosphere never captured the dynamics of the relation between reality and mind and their intricate interrelation and interdependency. The structuralist spirit of the behaviorist pragmatic view imposes the need for a methodological instrument, such as the synchronic frame in which diachronic action is quasicaptured. Within the semiosphere, only *differentiations* are possible. Impressive as a corpus of work, but often rather speculative in nature, it shows only the results of the Cartesian foundation of a misappropriated pragmatic-among them the "erection of the New Tower of Babel which is contemporary semiotics," (Notes, 13).

The restoration of the pragmatic foundation, which is actually taking place in our days within various semiotic schools (Soviet included), involves the need to understand Peirce's conversion to realism and why nominalism, irregardless of its nuances or ideological bias, cannot house a true pragmatic conception. What is even more important for our understanding of what happened at the moment Morris mystified Peirce, and what has happened ever since the attempt to make pragmatism a viable semiotic concept, can be read in Peirce's notes: "Everybody ought to be a

nominalist at first, and continue in that opinion until he is driven out of it by the *force majeure* of irreconcilable facts," (CP 4.1).

3. *On the reality of the mind*

Facts of semiotic interest, such as ones we notice in analyzing or practicing representation, communication, and expressive forms, are facts of reality and as such should be understood as facts of experience-a special type of experience. They have a formal nature. Whether semioticians apply formalization or not is here a non-issue. This has already caused enough heated and never settled disputes from which our understanding of pragmatics has not gained anything, in spite of the pragmatic implications of the subject. The language of semiotics (used by those working in the field) was always influenced by the languages to which it referred (by the domain-specific representation, in other words). Even the most abstract level of semiotics is reached with the understanding that, no matter what is discovered at this abstract level, communication of these discoveries will have to follow in order to validate (in and outside the scientific community) and evaluate (socially and in other ways) the results. Semiotics actually makes possible distinctions never made before or never used with awareness of those distinctions. It also provides means for "recycling" old distinctions in new pragmatic contexts. The reason for semiotic distinctions originates from sign pragmatics, which means from everything involved in the process of making our ideas clear (and the scientific implications of this endless process). Unlike any other distinction, semiotic distinctions are multidimensional, i.e., they occur in the space of interdisciplinarity. The reason for semiotic distinction is to establish an identity, not by forcing reduction of the identified subject, as specialized activities do, but by integrating various distinctions, i.e., by examining various aspects which characterize the identified semiotic subject.

Semiotic discourse is only apparently analytic—to the same extent that medical diagnosis or cooking is analytical—while nevertheless displaying analytic instances. It contains rules describing the conditions under which semioses of various types take place. Semiosis is sign process, but only if we accept that to interpret a sign means to be part of the sign. Later this condition will have to be restricted even more in order to explain how and why sign processes are human processes. The rules depend upon the nature of the sign process, which is the same as saying that they are pragmatically determined. These rules constitute the operational aspect of sign pragmatics. The object to which these rules are applied are signs, mainly signs functioning in the context of representation. Complex rules often constitute prohibitive or suggested/recommended orders, reason for which people (laymen in semiotics and semioticians) associate the qualifier *power* to the semiotic action. Indeed, power is exercised socially not by action as such (*brute force*) but by defining when action is permissible and when it is not, and which rules are acceptable. This is what is meant when people refer to the symbolic character of power.

Types of semioses are determined through semiotic constraints, which can be called filters. Filters indicate acceptable or unacceptable kinds of sign processes (the semiotic filter of political criticism in oppressed societies, logical operators such as ∃, ∀, etc. in predicate calculus, color combinations in art or in computer graphics, etc.). At some moment, it becomes apparent that in dealing with signs, rules, orders, filters, and other semiotic devices, we follow patterns of which we are not entirely aware as when we apply the syntactic rules of our language without knowing what the rules are, and what their justification is. The elements that we are aware of are those commonly associated with culture and proliferated through the semiotic institutions characteristic of a certain culture (school, church, press, etc.). The elements that, through discovery (heuristics), become the object of our awareness change culture. The process involves conflicts and a certain emotional component that affects the pragmatic level. It also involves the act of erasing (on which the entire Deconstructivist school of thought and *Derridaen* pragmatics rest). Semiotics only explains; there is no such thing as semiotic proof, or even semiotic demonstration. Its method is the argument. It is a processing of raw material in view of extracting some less expected component, precious because it reflects the coherence and integrity (in a broad epistemological sense) of human nature. (*To clarify* once meant to make silver, which metaphorically pretty much covers the work of a semiotician working on texts, artificial languages, images, medicine, judicial aspects, etc.) The degree of semiotic certainty is represented by the degree of certainty of the rules governing semioses leading to explanations.

Some parts of these rules are immediately accessible to our rationality; others require intellectual and emotional participation in processes extending far beyond our lifetime. Explanations are de-implementations of rules. They result from applying some kind of reverse engineering and have a degree of certainty comparable to that of proofs or demonstrations. Semiotic knowledge seems to be about a universe in continuous expansion and diversification. In reality, it projects upon its object an uninterrupted flux of questions and hypotheses, concealing what is apparent, obscuring what became a rule of routine, and bringing to the forefront what is questionable and what requires unprecedented rules in order to be understood and explained.

These remarks are less descriptive than the one used in presenting the behavioristic approach. There are many reasons for this. For one, mentalistic schools of pragmatic intent or method, such as those associated with Bense, Derrida, in part Eco, Savan, etc., are less unitary in their premise or intellectual purport. On the other hand, the remarks outlined above are at the same time constitutive for the entire paradigm (one) shared during a certain phase of my work in and outside semiotics. It is interesting how basic research, offering generalizations that rarely branch out into structures of detail—and when they do, tend to get lost in detail (see the plethora of Derrida followers)—remains vulnerable to a criticism that refers more to the language used than to the substance, i.e., to the apparent syntax of the theory and not to its peculiar pragmatic. Indeed, the basic attitude is philosophic realism, disguised almost pathetically in all sorts of "dressings," and it is quite strange to see how even Marxist semioticians feel comfortable under this scholastic flag (let me mention here Pelc, Nowakowska, Marcus, etc.). The interpretation of the sign, which is the main pragmatic function, actually means the building of meaning as an instance of the sign process (substantiation). Literary and art criticism enthusiastically embraced this particular pragmatic direction, especially in view of the difficulties in ascertaining or proving semiotic intentions in fiction, poetry, drama writing, and the plastic and performing arts. The continuous reconstruction of the sign in the act of its interpretation is very close to the spirit of Peirce's philosophy, but at its extreme, it questions the validity of any critical discourse (scientific, philosophic, social, aesthetic, etc.). In its more objective directions, such as those applying mathematical descriptions of phenomena interpreted semiotically, and discovering the conditions under which certain interpretations become necessary (see the works of Savan, Marcus, Brainerd, etc.), the validity of the critical discourse becomes an issue of coherence. Quite often the horizon of the interpretation of signs as logical mechanisms, especially deductions, is suggested within this type of pragmatic attitude.

Less ideological in its program, more restricted to particular pragmatic situations and affected by the metalanguage used, the mentalistic orientation disappoints through its lack of authentic interdisciplinarity (after ascertaining the need for interdisciplinarity and the role it is supposed to play). In search of the "means and mechanisms by which signs are processed". Floyd Merrell (1982, p. vii) deals with "thought experiments," used throughout "to integrate diverse levels of semiotic processes." He describes how an experience analogous to the creative process leading to the generation of a book is re-created in the reader. In the tradition of an ideal of literacy, Merrell's book suggests the potential "infinity of texts and mental worlds," (Notes, 14). Meinong's influence (through his theory of mental objects) on this kind of research cannot be ignored. From him derived, I suppose, all the interest in the absent sign, in the "non-existent" which however exists semiotically in our mind (Notes, 15).

Almost closing this account, Umberto Eco's formulation, "The sign as the locus (constantly interrogated) for the semiotic process constitutes [...] the instrument through which the subject is continuously made and unmade," suggests that we can understand mentalistic sign concepts and their specific pragmatics against the background of a *sui generis* history of humankind. He continues: "The map of semiosis, as defined at a given stage of historical development (with the debris carried over from previous semiosis), tells us who we are and what (or how) we think," (1984, p. 45). With this particular paradigm, the reflective moment in semiotics is especially important. The self-critical moment, which characterizes each sign process, is relevant to a semiotic conception that proclaims the constitutive nature of signs. As an effect of this moment, pragmatic feedback takes place. Kristeva (1969, p. 30), obviously influenced by Peirce, states: "Semiotics cannot develop except as a critique of semiotics. At every moment in its development, semiotics ought to theorize its own object, its own method, as well as the relationship between them; hence it theorizes itself and becomes, by turning on itself, the theory of its own semiotic praxis...." The normative nature of Kristeva's

assertion might be misleading if the statement is not put in the larger framework of emancipatory expectations. The semiotics considered here is supposed to be practiced with self-consciousness, in awareness of possibilities, critical towards semiotic realities, and in full anticipation of new forms of semiotic practice. From a narrower perspective, her remark suggestively describes phenomena all semioticians encounter when falling prey to terminology (and practicing it as an end in itself), or to some quasi–methodology. Probably the most blatant example, which has produced a number of critical reactions, is the obsession of semioticians with taxonomies. Some believe—and Kristeva correctly suggests a way out of this situation—that all that semiotic discourse is supposed to produce is classifications of signs (and possibly sign processes). The way out is to understand the relevance of criteria for classification, the implicit dynamics of each taxonomy, and the reason why accuracy can sometimes be counterproductive (for instance when it becomes unexpressive, hence insignificant). The excessive analytic spirit leads us to trade in parts for wholes; and if we are not aware that the *dissected* sign is actually a different reality than the *sum* of its parts, we shall maintain hopes never to be fulfilled. Once the status of semiotics as *self-theory* is understood and reflected in our methods, semioticians will hopefully spend less time in establishing new taxonomies and more in applying what we learn from examining classifications produced over time (or even better, those relations on whose basis parts are articulated, constituting whole sign systems with a dynamics almost never captured in our labels). In this vein, it should be noted that Kristeva's remark suggestively describes phenomena all semioticians encounter.

The need for a better inner structure, for focus, and for recognizing areas of common concern or critical to the development of more appropriate semiotic explanations of significant aspects of science and other forms of human activity is reflected in broader projects (Notes, 16).

The particular semiotic direction discussed above seems to be constructed around two basic assumptions:
1. Explaining semiotics is part of the semiotic action.
2. The results of semiotic action are identifiable to the extent we want to account for them.
The second assumption says that in numerous instances of human praxis, explanations other than semiotic explanations (or no explanation at all) accompany semiotic action. The results might be assigned to different forms of human action (subsets of the encompassing semiotic action) and accounted for either from specialized points of view or from a metaphysical horizon. The willingness to semiotically account for results of semiotic action identifies the need for the semiotic corpus of knowledge.

As an objective artifact, semiotic explanations constitute only frames of mind. In concluding (relatively speaking) the search for the best pragmatic strategy, we will affect the claims on the final result, but not the structure of the semiotic approach. To make sense means to investigate the reality of the sign as identified in the mind and not in whatever happens to be the physical reality of that sign (book, painting, social order, political ceremony, etc.). What Karl Popper once called a "horizon of expectations" (1972, p.49) is, within this model of the sign, a dynamic semiotic matrix. The constitutive energy of conventions (analyzed in works by Todorov, Hirsch, Fish, Keynes, Bloom, etc.) allows the projection of such a matrix on the mirror that reflects what we put in front of it.

4. *Sign and Memory*

Recall that we agreed that to interpret a sign means to be the sign. This simply goes back to the definition that establishes the epistemological condition of the sign, i.e., its processual nature. While something can stand for something else ("in some respect or capacity," as Peirce so aptly expressed it), it does not become a sign unless *interpreted* as a sign. In the act of interpretation, we insert ourselves in the sign relation; that is, we give it "life." This led to a pragmatic equation: two individuals are similar to the extent that their interpretation of a sign is similar. Let me explain: For two signs to be interpreted in a similar way, they need not have a similar physical appearance (the word, the image, the taste, etc.), but they ought to "function" similarly, i.e., to be pragmatically similar (assuming identity of context). Fractals might be a useful mathematical formalism for describing similarities (especially self-similarities), in which case the dynamic aspects (as captured in the modern theories of chaos) are approached. I made this point elsewhere (Nadin, 1988). Another way to describe this similarity is through the mechanism of mathematical (or logical) machines, in which case the deterministic aspects are made evident.

What we want to do is to consider the morphism of mental predicate-predicate in a sign system, independent of the physical world in which this morphism program drives the theoretic machine (semiotics) whose functioning is representative of its pragmatics. Functions and relations in the physical world can be specified, and once specified, they can be *hard-wired* to support the transition from mind to the sign system considered. Quite early in my work (1977), I showed that an appropriate semiotic system capable of handling these morphisms is represented by machines describing formal languages, in particular computers (in which case the programs are the descriptions). The treatment of the sign in terms defined in fuzzy set theory corresponds to its nature as defined in the foundations of semiotics. As a reality, signs participate in semiotic processes by virtue of affecting other signs: "No sign can function as such . . . it is absolutely essential to a sign that it should affect another sign," (CP 8.225). Explaining in which respect Peirce already used fuzzy terminology, I showed (Nadin, 1980, p. 351 ff.) that synechism, "that tendency of philosophical thought which insists upon the idea of continuity as of prime importance in philosophy," (CP 6.169) is the core characteristic of this anticipation of the need to capture vagueness in sign systems. Continuity is regained in the fuzzy set concept as introduced by Zadeh (1965) and accounts for what Peirce considered a basic pragmatic requirement: "Continuity govern the whole domain of experience in every element of it," (CP 7.566). For a while Peirce confronted, almost like we have to do today, the problem of the representation of continuum through discrete signs. (We do it using the digital system.) He introduced the concept of potential collection (6.187), "indeterminate, yet capable of determination" (6.185), as well as the concept of vague: "It is vague, but yet with such a vagueness as permits of its accurate determination in regard to any particular object proposed for examination" (6.186).

In order to undertake the last step towards the analogy sign definition and the definition of a fuzzy automaton, we should keep in mind that the sign proper is a self-adjusting system, based on the feedback characteristic of sign processes. This is expressed in terms quite different from those used by Wiener in his foundational work in cybernetics, but unmistakably the spirit is the same: "The object of representation can be nothing but a representation of which the first interpretation is the interpretant [...] So there is an infinite regression here. Finally, the interpretant is nothing but another representation to which the torch of truth is handled along: and as a representation, it has its interpretant again. So, another infinite series" (1.338).

The definition of the sign: S=S(M,O,I,o,i) formalized and commented by Max Bense (Notes, 17) has an obvious, at least formal, analogy to the definition of an abstract automaton (Mealy, l955) given through a quintuple in the general form

A = A(X, Y, O, δ, λ) in which
X = finite set of inputs
Y = finite set of outputs
Q = finite set of states
δ = Q x X→Q = next state function or transition function
λ = Q x X→Y = next output function or output function.

Extending the analogy from abstract automata to abstract fuzzy automata followed an analysis of the sign definition and its pragmatic ramifications. Since some of the arguments are directly related to the topic developed here, it makes sense to restate them in an abbreviated form. Repertory relations (pertinent to the syntactic level of the sign), which can be represented by means of set theory, are fuzzy by definition in the sense that the characteristics of representamina can be more or less qualitative, singular, or have the appearance of some law (these characteristics are captured in the notions of Quali-, Sin-, and Legi-signs). Object relations, which describe the representation function of the sign,

are quite adequately captured in terms of category theory, in particular by extending the concept of morphism to fuzzy morphism and redefining categories as fuzzy. A sign being a system of states, i.e. of possibilities of realization, determined by the object for which the sign stands, the "cognition produced in the mind," (CP 1.370) can be seen as the output of the mathematical machine describing the sign.

Given an automaton M, minimizing the number of its states, which means minimizing the constitutive repertory, means finding another automaton so that M' ⊇ M, for which the number of states is minimal (minimum repertory supporting the embodiment of a desired interpretation). This is a very restrictive condition, fulfilled probably only by the system of language with its 26 to 28 letters (in all fairness, one should add diacritical signs and the ten digits). The problem raised can be solved using various algorithms.

A fuzzy abstract automaton (Moore type, cf. Negoita & Ralescu, 1975) can be represented by a quintuple in which the set of inputs (X), of outputs (Y), and of states (Q) are finite. The functions representing the dynamics and the output map, called δ and λ, are fuzzy relations, which means that they can be define

δ: X x Q x Q → [0,1]; δ: X x Q → X
λ: Q x Y → [0,1]; λ: Q → Y

If the initial state is represented by $q_o \in Q$ (a representamen chosen from a given repertory of signs), the fuzziness of the system considered is due to its specific functions, which is tantamount to saying that it results from the pragmatics in which the sign participates. The initial state of the semiotic machine can be described as a fuzzy subset of Q. In this case, this initial state is a fuzzy vector

$P_o = (i_1, i_2, \ldots i_n)$.

In the above relation, $i_j \in [0,1]$ is the degree of membership of the state $x_j \in X$ at the fuzzy initial state. The standard example for this case is the closed repertory in visual poetry, i.e. the relations established once the convention of iconicity is introduced. Concrete poetry is characterized by the attempt to visualize the subject of the poem. It is a form of visual poetry based on analogies and the mechanism of subtext. Appolinaire, among others, created quite a number of such "poems," lyrical expressions in which the means of representation are visual analogies. The convention of iconicity (i.e., resemblance; he uses words in order to write with them not lines of poetry, but the contour of whatever he wants to represent) requires that the signs used (in this case, words and shapes reminding of the object recalled) preserve their resemblance to what they are supposed to represent. The repertory is only a subset of the repertory of words, limited by the very rule that the artist/poet decided to pursue.

The dynamics δ can be viewed as a family of fuzzy matrices over [0,1]. For $q_i, q_j \in X$, we shall denote $\delta q_i, q_j(x) = \delta(q_i, x, q_j)$, and thus $x \in X \triangleright T_x \in FM(x)$, $T_x = (\delta_{qi}, q_j(x))$.

Let us observe that a fuzzy matrix FM—or matrix over [0,1] (an ordered semi-ring)—is a function (Zadeh, 1968) A :{1,2,...m} x {1,2, ...n} → G ; or, $M=(m_{i,j})$ is called an FM if $0 \leq m_{i,j} \leq 1$.

Usually, the functions δ and λ are given through FM. So, if at the moment t the input is x_1, then

$T^t_{x1} = (\delta^1_{ij}(t))_{ij}$ and $\delta^1_{i,j}(t) = \delta(x_1, q_i, q_j) = (x(t))$.

$\lambda_{i,j}(t) = \lambda(q(t))$

q(t+1) / qt	q1 q2... qv... qn
q1	.
q2	.
.	.
.	.
qn	$\lambda(x_1, q_n, q_v)$
.	.
qp	.

All events that can be represented in Mealy's type of finite automata are regular events (Marcus, 1964). The same holds true for events represented by fuzzy automata. Semiotic processes are regular. A sign's derivation from another sign, which is expressed by the functioning of the fuzzy automata, is not only a generative process, but also explains the structure of the process and has an explanation function resulting from its analytical opening. A finite automaton is the type most particular to a Turing machine. The fuzzy Turing machine (FTM) has the condition of an algorithm and not of a sign. It is also defined through a quintuple analogous to that of a sign F ={A, B, X, δ, i} in which

A = printing alphabet
B = auxiliary alphabet (special symbols)
X = set of internal sets
δ: X x U x V x X → [0, 1] the transition function
i: X → [0,1] the fuzzy initial state and
U = A ∪ B; V = U ∪ {+1, -1,0}, in which +1, -1, 0 represent the possible moves to the right, left, or the procedure's end, respectively.

The behavior of a FTM is analogous to that of a FM and suggests the analogy between sign processes and learning processes.

We can benefit from the definition remembering that Turing machines (TM) are distributed between TM free of any restriction and TM as finite automata. The weakest condition that can be imposed upon a grammar is to include it in the class of TM free of any restriction. The most restrictive is to be a Markov source, i.e., a finite automaton or, more precisely, a fuzzy finite abstract automaton (FFAA), a condition that we saw that the sign fulfills. Within the frame of scholastic realism, Peirce considered that "the highest grade of reality is only reached by signs," (CP 8.327). Thus the functioning of the FFAA becomes the testbed for the pragmatics of the sign as a theoretic device participating in the semioses through which our ideas gain clarity. The inferential character of the analogy suggested above accommodates quite well the spirit in which Peirce stated that "every state of consciousness [is] an inference, so that life is but a sentence or a train of thought," (CP 7.583). The pragmatic implications of the inferential nature of sign processes will be shortly considered in greater detail. At that time, it will also become obvious that Peirce's sign definition has to be improved in order to accommodate cognitive functions of the mind which, although intrinsic to the semiotic

concept he developed, he did not finally take into consideration.

Having the nature of a universal, signs can be evaluated only through other signs. Hence, the pragmatics of signs is a semiotic issue best represented by the infinity of semioses as instances of explanation and as participatory elements in proofs or demonstrations. It involves the human being insofar as each time we compare or explain signs, we compare and explain the human being"...as thought [the sign] is a species of symbol, the general answer to the question 'what is man?' is that he is a symbol. To find a more specific answer we should compare man with some other symbol," (CP 7.583). And this comparison is, of course, the pragmatics of the sign. As opposed to the nominalist constitution of a pragmatic level of semiotics, the realistic constitution has the pragmatic level as its foundation (it is its first category), deriving each other level from it. It is not that pragmatics results from a given syntax and the semantics made possible by it, but the other way around—a certain pragmatic function requires an appropriate semantics and has as an effect a certain syntax from may others possible.

This observation is of extreme practical importance. It explains why until now, starting with syntax and building up the next level, we have almost never succeeded in attaining a desired pragmatic level, neither in designing artificial languages nor in more elaborate applications such as instruction, education, politics, advertisement, etc. For as long as signs are considered and used as behavioral signals, the syntax is indeed the place to start with. But once we understand the broader implications of semiotic action, we will be able to overcome the limitations of this cause and effect model and to start thinking according to the premise of mediation implicit in the sign definition and characteristic of the pragmatic level of semiotics.

Peirce defined three fields of the interpretant: *immediate* ("The Quality of the Impression that a sign is fit to produce"); *dynamic* (whatever interpretation any mind actually makes of a sign"); *final* (defined by a negation, it "does not consist in the way in which any mind does act but in the way in which every mind would act," CP 8.314, 8.315). These correspond to the degree to which a sign will be interpreted in a *Rhematic, Dicent* or *Argument* manner. In a different context, an example of applying the FFAA description to a specific case (interpreting colors from a semiotic perspective) was given (Nadin, 1977, pp.23-25). This example, as well as others (Zadeh's analysis of the identifier *young* or *bold,* my attempt to define value concepts, such as *good, expressive,* etc.) proves that the analogy between sign processes and the functioning of the fuzzy abstract automaton (descriptions of the sign process) allows us to better understand such characteristics of the pragmatic level of semiotics as processuality, continuity, distinction, and incompleteness. The triadic sign relations have a fuzzy *implicit* nature. This is quite obvious in the way signs participate in the formation of languages or sublanguages. Languages generated by fuzzy automata and determined to a certain extent by fuzzy grammars constitute a reality that accounts for the fuzzy character of our thinking and the fuzzy nature of our concepts. The transition from signs of higher semioticity (defined by Max Bense, 1971, as *bewußtseinsunmittelbarer*, i.e., conscious-immediate,) to lower semioticity (*weltunmittelbarre*, i.e., world-immediate) is also captured in the FFAA description, especially if we approach the minimization of the automaton. The "triple connections" of signs—"sign, thing signified, cognition produced in the mind"—are continuously reproduced in the functioning of the sign. Peirce's rather strict triadic-trichotomic model is the conceptual attempt at the minimization of the sign "machine." At the other extreme, we have the practice of "maximization" corresponding to the pragmatics of ambiguity, characteristic of such semiotic activities as poetry, fiction, art, and, to a certain degree, philosophy (not to mention the pragmatics of political or ideological discourse).

Noticing now that any digital computer is equivalent to a Turing machine, we are aware of the fact that mental predicates can be "reduced" to fuzzy Turing machine predicates, more precisely, to such descriptions. Functionalism in its barebones form acknowledges correspondences such as hardware-software brain-mind (or the like) and extends the analogy discussion even to the memory aspect, where some arguments simply refuse to hold water. The discussion is much too elaborate to be even summarized here, but one basic observation will help clarify the issue. We do not remember things; we remember their representations, i.e., signs; we remember *states* of the "semiotic machine." These states are pragmatic instances of the semiotic activity. So the problem is: How are signs both storage (for whatever is memorized, say a poem, or the density of a substance, name of a person, etc.) and stored? That is, how are they "containers" for signs and mechanisms for retrieving, i.e., reconstituting, signs? Connectionists of all kinds did their best to discover the neural background of memory, all assuming an inner storage level. As a semiotician involved in cognitive studies, I felt that this approach is doomed to fail simply because, the self being a sign, it is itself, according to Peirce's proof, external, like all signs. It "must address itself to some other, must determine some other, since that is the essence of a sign."

Pragmati(ci)sm addresses the *community of interpretation* (a term coming from Royce, as far as I know). Storing and recalling are intimately connected, and I have sound reasons for believing that this excess memory storage required in computers is a consequence of applying the wrong strategy because our understanding of the cognitive aspects of memory, i.e., the semiotics of memory, is so superficial. We prefer to increase storage capacity (cheaper and cheaper) instead of looking for an improved understanding of the problem. Moreover, each time a new computer, more powerful and with more storage, is made available, we seem to need only a week or so before using it to its limits.

Obviously, semiotics cannot be blamed for this, but since it integrated cognitive aspects in its domain, it would not be out of place to ask how much of what we have learned from explaining the semiotic functioning of the human being can be used in the design of better machines, and, moreover, how. In recent years, Fodor, Eco, Dennet, and quite a few others have expressed interest in the subject and started exploring it. This interest is of a pragmatic nature. Eco (1985, p. 9), addressing a conference on pragmatics suggested that "We should conceive of two different pragmatic approaches: there is a pragmatics of signification (how to represent in a semantic system pragmatic phenomena) and a pragmatics of communication (how to analyze pragmatic phenomena that take place in the course of a communicative process)." He goes on to develop a suggestion from Bar-Hillel (1970) concerning pragmatism, and deals with the very important subject of background knowledge. In concert with others (Notes, 18), he goes on to say that "researchers in Artificial Intelligence have convincingly demonstrated that there are certain standard frames, scripts or goals that can be recorded as a part of the average competence of a social group," (Eco, 1985, p. 16). Knowing why Eco does not challenge this view—his semiotics is one of Encyclopedia, along the line of Leibniz fascinating project of a general doctrine of signs—does not mean that I accept it. For limited tasks, frames or scripts perform acceptably. For broader tasks, where the issue of integrating background knowledge is important, i.e., where we need some "communication" between the frames, this does not happen because the strategy is wrong. Actually, human beings do not process signs within frames, but constitute newer and newer frames, in a process of continuous reconfiguration of both their knowledge and their strategy for processing new information. It is as though semiotic processes were part of this re-mapping of the mind and even "anticipate" instances of interpretation, pragmatic contexts. The anticipatory nature of our thinking—which will be discussed even further in the next section—corresponds to the way we as signs go through all the instances through which signs are constituted (pragmatic level), defined (semantically), and actually embodied (syntax). The dominant model for almost the entire history of the sign concept—that of the human subject merely “re-acting” to signs—influenced decisions made when computers were conceived and built, programs written, and cognitive theories developed.

Experimental data confirming my hypothesis that our minds operate in *anticipation of problems* is becoming available almost at the time this study is being completed. The anticipatory function (regarding earthquakes, flood, long and harsh winters, etc.), which we attribute mainly to animals and plants (calling it instinct and explaining it in terms of closeness to "Mother Nature"), is strictly semiotic and determinant for the pragmatic level of the sign. In a text from summer l873 published in the *Writings of Charles S. Peirce* (1986, Vol. III), we read that the significance of thought lies in its reference to the future," and understood why the editors decided to use this almost last sentence as the title. It summarizes a very important idea in view of the future work that Peirce will accomplish in establishing the Pragmatic Maxim.

5. *The Inference Engine*

We are multiprogrammed: genetically, socially, culturally, politically, economically, etc. We program genetic, social, cultural, political, and economic processes. In other words we are programmed to a certain extent, and we are programming creatures. Suggesting a new identifier for

the human species, *homo algorithmus* (quite acceptable in this day and age of computation hype and obsession with algorithms), I actually critically identify what differentiates us from the previous representatives of the species and what, if any, is the dominant characteristic that we have acquired in the meanwhile. Once put on paper, the formula *homo algorithmus* makes us think about what is involved in designing and implementing algorithms. And if we want to go to the root of the tree, we will again find the sign concept together with the semiotic operations of substitution, omission, and insertion as the system of rules that we apply (Notes, 19). Felix Hausdorff (alias Paul Mongre; 1897) would claim, if alive, that *zoon semiotikon* already implies the possibility of *homo algorithmus,* and that there is even more to his formula than we are aware of, i.e., that we move from a civilization of literacy, dominated by a well defined system of signs called *language,* to a new civilization, in which various sign systems will be used in a more interdependent type of semiotic praxis. My hypothesis, which follows the formal structure of an abduction,

b
(a b)
infer a

is an example along the line of the final thesis introduced in "Pragmatics in the Semiotic Frame": The pragmatics of the sign follows the path of abduction (Nadin, 1987, p 166). Indeed sign diversification (b, in the above formula) and a certain noticeable degradation of literacy (a b) suggest the abduction *new form of civilization* (which I call the *civilization of illiteracy, 1983, 1997*), in which a different kind of pragmatics is possible. The semiotics of algorithmic activity is only part of the more general semiotic praxis of those constituting this civilization. As a mechanism for generating explanations about what we see around us, abduction—sometimes called *hypothesis,* or confused with *deduction*—is the semiotic operation per se. It represents a special type of inference characterized by its processuality. When Jean-Francois Lyotard wrote that "the statutes of knowledge change when society enters the so-called post-industrial age and culture the post-modern," (1979, p.12) he used, without naming it, the mechanism of abduction for explaining the new forms of semiotic activity as we encounter them in architecture, writing, philosophy, cuisine, etc.

The post-industrial can be semiotically identified through the sign representing it. The representamen (sign as sign) is the processing of information. Its object is the ensemble of human relations and of man-machine relations as mediated by signs, such as those constituting interfaces. The interpretant is the awareness (process in time) of the meta-level of knowledge and the relations between the object level and the meta-level. In order to semiotically define postmodern semiosis, we shall have to proceed in the same way. The representamen is the set of recycled signs from previous forms of art and culture (science included); the object, the separation of the logical mechanism of intelligence from perceptual content; the interpretant, the awareness that signs are real and con constitute the substance of new critical statements based on "quotes," "recycled" language, and collage. Information processing, becoming a dominant mode of human activity, restricts semioses, but also makes possible sign processes unprecedented in previous phases of human development, such as modeling, information processing (numerical and symbolic), and other complex semiotic activities. Our new tools are programs, and as such, a program called "word processing" is *all* the typewriters ever built in the world, plus some of the knowledge required for writing. The semiotic competence represented by the rules which we use for organizing the text is provided through the program; so is spelling, so is the dictionary (synonyms, antonyms, homonyms, etc.). The knowledge embodied in such a program comes from our own knowledge, stored and made available in an environment in which some other signs are used to make it what is called today "user-friendly." Although it is quite trivial in our days to show how certain tools can be modeled in programs and reproduced in their basic functions, it is less trivial to ask whether thought and consciousness are reproducible in programs. However, even posing the question testifies to the postmodern condition as attempts to "recycle" previous knowledge and to constitute a critical viewpoint that will become evident in the act of interpretation.

The *constitutive* function of the post-modern is one of search. Accordingly, the pragmatic level of the semioses defining the post-modern is represented by search in all sorts of "trees," and by "pruning" strategies to reduce the search, so that the time necessary to run through the signs used for various explanations is brought to a supportable minimum. While the language I use here comes from the less specialized areas of computer science jargon, it actually applies to non-computer supported work as well, i.e., to any form of semiotically mediated activity. It shows how, in order to constitute ideas, we identify the need for expressive and communicative signs, which in turn influence the way we think about the phenomena approached. Indeed, for John Stuart Mill and his followers, "Hello" meant only what it would denote—its reference, which does not exist. After Wittgenstein, "Hello," as well as the entire computer jargon, means its *use*. By abduction, we can infer from what it might be to what it is with the help of the context of use. This is the pragmatic level of the signs used in the post-industrial. The meaning of each program is not the meaning of the sequence of statements following each other according to some syntactic rules or semantic conventions, but its use. By no accident, in my opinion, Peirce anticipated the logic machine. Kenneth L. Ketner undoubtedly leads the research in the Peircean heritage pertinent to computers (Notes, 20). In his most recent study (Peirce and Turing, 1986, to appear in *Semiotica*), Ketner suggests, a little too vaguely for my taste, "Peirce's logical algebras and that his logical graphs and Turing's 'machines' are all diagrams," (1986, p. 27). This thought can be understood only in the context of the larger concept of Peirce's thinking:

> The first thing I found out were that all mathematical reasoning is diagrammatic and that all necessary reasoning is mathematical reasoning, no matter how simple it may be. By diagrammatic reasoning, I mean reasoning which constructs a diagram according to a precept expressed in general terms, performs experiments upon this diagram, notes their results, and expresses this in general terms.

Diagrams are algebras, matrices, arrays, mathematical notation, maps, plans, etc. and obviously Euclid's figures (favorites in his papers). Ketner goes so far as to state that "Indeed, 'diagram' for Peirce is roughly equivalent to a generalized notion of 'model,' " (Ketner, 1986, p. 19). But what is especially relevant for the discussion I started in this section is the fact that both Turing and Peirce dealt with the boundary conditions of reasoning, of what is called today *intelligence*. Ketner is right in stating that Turing, by defining what is not computable "has established a negative mode version of Peirce's thesis that ... mathematical method is a living, creative, observational, experimental procedure," (Ketner, 1986, p. 31). This is the essence of the pragmatic method. In accordance with its spirit, as defined in the concept of sign process and the process character of the interpretant, we can say that it covers the so-called non-monotonic reasoning, which is the same as acknowledging that our understanding of the world changes over time, i.e., that we need to discard previous conclusions in the presence of new information.

The non-monotonicity of semiotics, defined by Peirce as a new name for logic, explains how, in our semiotic praxis, we continuously test our hypotheses, discard those inappropriate, and construct better ones. This is actually the core of the pragmatic method. Default logic prevents invalidation of inferences as they would occur if nothing changed in our semiotic condition. "Inferring is the sole act of cognitive mind," observed Max Fisch (1978, p. 36) in one of those remarkable analyses of Peircean texts which made him the authority in Peirce studies today. We are always in situations of incomplete knowledge about the world, but we dispose of semiotic mechanisms to make plausible inferences based either on rules such as "Unless there is knowledge to the contrary, assume that..." or on limited default reasoning, which boils down to saying that we continuously reduce, through semiotic procedures belonging to the pragmatic level of the sign, the infinite to the finite of the situation, set of events considered, and language used in a precise context. It is an implementation of Cantor's idea, despite the fact that Peirce noticed that Cantor's continuum is only a *pseudocontinuum*. The attempt to model human intelligence in the realm of the artificial can be seen as a knowledge semiosis. The more we succeed, the more we know about the subject. Abductions are plausible (show association with statistic models) or probable (probabilistic) or possible (possibilistic) *inferences.* In order to augment their predictive value, we have to introduce some weighing procedure. In view of the fact that the sign definition supports an analogy to fuzzy machines, I considered that fuzziness and the associated concept of *possibility,* which Zadeh introduced (1965) in conjunction with fuzzy sets, are better means than statistics or probability of "weighing" the relevance of terms constituting abductions. Inference networks, much closer to the way we actually interpret signs (we being those signs, as already explained) never before encountered, represent the pragmatic dimension in its multidimensionality, which sometimes become lost when we refer only to a tree search or a pruning procedure. Pruning itself is a probabilistic decision, if not determined possibilistically, which would come closer to the nature of the entities on which we operate when we actually perform such searches or pruning.

Understanding by intuition a "cognition not determined by a previous cognition," (CP 3.567), Peirce quite unequivocally stated that our notion of ourselves is the result of an inference. Since it is not based on previous knowledge, this inference must result from something else. Interpreting signs does not mean, as people thought for a long time, only to constitute those signs, but actually to embody them (*instantiate*) as instances of the process called the interpretant. This self-constitution is one of our mind, i.e., of a semiotic configuration of this mind, in anticipation of texts, images, music, mythomagical occurrences, political ceremonies, legal principles, and symptoms (meteorological, medical, mechanical, etc.). It is never neutral in respect to the anticipated. It might represent desires, goals, expectations, biases, or anything else involved in the way we bridge from present to future states. It can be confirmed, or it can lead to new configurations (corresponding to worst-case scenarios: "Be prepared for..."). I assume (and this is indeed speculation) that when Heraclitus said "Much learning does not teach understanding" (as quoted by Diogenes), he might have had in mind that it is not by storing, retrieving, and matching knowledge that we understand things or events, but rather by *throwing various nets,* in anticipation of questions, of situations, of decisions to be made. Yes, in this process "Everything flows and nothing abides" (quoted by Plato in Cartylus) and "that which is at variance with itself agrees with itself" (quoted by Hyppolitus and Plutarch, Notes, 21). Leibniz, in *New Essays on Understanding* (1704) adds one more argument, "Nothing takes place all at once, and it is one of my greatest maxims, and one of the most verified, that *nature never makes leaps*."

The preparatory phase that our mind maintains in its successive reconfigurations indeed eliminates leaps. As a dynamic functional reality, our mind might maintain what W. Zenon Pylyshyn (Notes, 22) calls a transducer, "bridge from physical to symbolic." The transducer consists of, among other components, a hard-wired relations component. In the process of continuous reconfiguration of our mind, the transducer keeps the cognitive clock synchronized with physically reality. Phenomena of aging, for example, can be seen, from a pragmatic level of semiotic perspective, as phenomena of desynchronization and of progressive loss of the ability to anticipate and to reconfigurate. A mapping process describes the functioning of the transducer; patterns received by the transducer at both its ends (from the mind on one side and from the physical world on the other) are checked against each other in view of their making sense or being disjoint. Human coherence and integrity, mentioned in the introductory lines of the study, is accomplished at this stage.

Although we are approaching a different subject here, it is very important for understanding the relevance of the semiotic approach in general, and the pragmatic level in particular. This subject is mind and computability. Saying that the mind has the nature of sign, and that its functioning corresponds to the dynamic semiotic reconfigurations through which it identifies itself in various contexts, does not answer the question of whether the mind can be duplicated in some computational model, a question which today represents the frontier in science as well as in the humanities. At this stage of our knowledge about computation, we have accepted that not every aspect of our cognitive condition can be modeled by machines. Turing restricted himself to the computable aspects. Recently Peter Kugel (1985/86, p. 141) suggested that we "look at parts of human thinking that seem (to some of us) to involve more than computing and try to develop precise *uncomputable* models of them." For this purpose, he applies the mathematical theory of uncomputability (or recursion theory). Indeed, there is a need to take the discussion out of the emotional and culturally biased context in which we contemplate our substitution by machines and bring it to the realm of a theoretical controversy in which we compare not minds but models of the mind.

Within this context, we might be able to understand that there is a major epistemological error that we keep committing. We talk about the mind instead of minds; we deal with an "atom" and with the complex through which this atom is identified. Both Peirce and Ferdinand de Saussure understood the social implications of a sign theory. The constitution and continuous reconfiguration of our mind is a process that takes place in interaction with other minds. Mind does not exist as a singular entity. Its condition is plurality, and semiotic networking is the concrete form of this plurality. Sometimes minds share a physical space and a common time; other times they become what they are in virtue of an interaction independent of time or space, or constitute new forms of space and time relations of a conventional nature. Minds can be modeled, to a certain degree of efficiency, as information processing devices. (I will not discuss here objections based on Gibson's ecological model.) But this modeling lacks components which are not reducible to information (represented by numbers or by signs), especially encoding and decoding, which as we know maintain the information. Codes are pragmatic devices which enable us to continuously redefine, clarify, and re-examine our ideas in one's own mind or against the minds of those through whom our own exists. Lotman may actually be right in suspecting that culture duplicates the asymmetry of the individual brain. What we need now is to test and experiment with such suspicions, or with better founded hypotheses, in order to use the potential of semiotics to it maximum. Paraphrasing Levi-Strauss, we can say that semiotics is no more founded on the basis of our previous sign experience than our mind on information processing. Intelligence is process.

Notes

1. See, for instance, F. Dewey, 1946. Dewey criticizes Morris in rather unambiguous terms: "The misrepresentation in question consists in converting *Interpretant,* as used by Peirce, into a personal user or interpreter... I do not believe that it is possible to exaggerate the scorn with which Peirce would treat the notion of *what* interprets a given linguistic sign can be left to the whim or caprice of those who happen to use it," (p.87).
2. Umberto Eco's comments on the subject in his novel *The Name of the Rose,* not exactly meant to be scholarly work, are "right on the money" (to use the journalistic style which so often seduced him). Reading the novel, I wondered whether Morris (psychologist, philosopher, poet, scribe, teacher, etc.) served as inspiration for one of the characters belonging to the paradigmatic human universe of the monastery.
3. "The Ethics of Terminology", C.P. 2.219 ff., should be seen as a component of semiotics in the sense that our concepts participate in gnoseological processes not only as descriptions of such processes, or as labels, but as constitutive components.
4. Peirce cannot be associated with Morris—enough reasons for those who have not yet understood this will be provided in the text to follow. Although he, too, has a system vision of semiotics, Ferdinand de Saussure missed the dynamics of the language, etc. in his reputed distinction *langue* and *parole.*
5. See J. M. Lotman 1977, p. 1-18. This text deserves far more attention than it has received. Culture is defined here as a collective mind, and this finding is then extended according to the hypothesis of the asymmetric brain resulting in the thesis that culture should also be seen as asymmetrical.
6. F. Culler 1981, p. 25. He goes on to say: "If we are to understand our social and cultural world, we must think not of independent objects but of symbolic structures, systems of relations which, by enabling objects and actions to have meaning, create a human universe." The books mentioned are Cassirer's *The Philosophy of Symbolic Forms,* Alfred North Whitehead's *Symbolism: Its Meanings and Effects,* and Susanne K. Langer's *Philosophy in a New Key.*
7. Cf. *The Pursuit of Signs,* p. 27. Culler was speaking about three distinct directions: the geology of signs, psychoanalysis, and economic history as actually defined by Claude Levi-Strauss in his foundational work in anthropology.
8. When Lotman and Uspenskij write about a system of "prescriptions and prohibitions," the reader informed of or with experience in the system cannot but notice the double code used. (Let us not fall prey to some Freudian semiological speculation characteristic of a different kind of pragmatics, to be mentioned in due time within this section).
9. *The Semiotic Sphere,* edited by Thomas A. Sebeok and Jean Umiker-Sebeok 1985, gives a rather detailed account on the subject. A less useful account by R. W. Bailey, L. Matejka, and P. Steiner 1978, should also be mentioned here. Obviously, biases of all sorts can be noticed in both, but at least the most recent account has a higher academic standard.
10. See F. Rossi-Landi 1968 (1983). Rossi-Landi writes: "Marxists considered semiotics and other human sciences as 'bourgeois' and 'separatist,' whereas human scientists considered Marxism to be 'non-scientific,' or 'scientific in fields that are not our own.' The consequence of this was that Marxists *despised* semiotics, while human scientists were *afraid* of it because of the unifying power of a generalized science of *all* systems of signs." (Cf. Preface, p. x.)

11. The text also illustrates Upenskij's historic method; cf. J.M. Lotman and B Uspenskij 1984, p.295-300
12. From stage, to life, and then again into art (canvas) is the line Lotman analyzes here; cf. J. M. Lotman and B. Uspenskij l984, p. 165-175.
13. Cf. E. Rochberg-Halton and K. McMurtrey 1983. This is an excellent article discussing the implications of the change in the philosophic foundation of modern semiotics.
14. He goes on to say: "Rather than wallow in the muck of a relativistic epistemology that can only culminate in nihilism, this hypothesis allows us to maintain the idea that any particular system and any particular theory constitutes only an approximation..." (cf. F. Merrell 1982, p. 148). These are the concluding sentences of the book.
15. J. N. Findlay 1963 gave a clear presentation of *Meinong's Theory of Objects and Values*.
16. Such as dictionaries-we have to mention the Greimas-Courtes dictionary of 1979, translated into English in 1983; Bense-Walther, *Worterbuch der Semiotik,* l973; and more recently Winfried Noth, *Handbuch der Semiotik,* 1985; applied workshops-too many to mention-a volume on iconicity-celebrating Sebeok's 65th birthday; and a host of thematic issues in semiotic journals.
17. "[...] Damit ist ein (Peirce-) Zeichen durch drei nichtleere Mengen M, O, I sowie zwei auf diesen Mengen definierte Operationen festgelegt: Z= Z(M,O,I,o,i). [...] o ist die Bezeichnungsoperation des Zeichens bzw. die Objektion, und i ist die Bedeutungsoperation, die sich auf die Bezeichnung bezieht, bzw. die objektionsbezogene Interpretation."
Except for the never justified conversion from representamen to *Mittel,* this formulation can serve as a starting point. Cf. M. Bense l971, p. 34. Bense (1971) was first to suggest the formal analogy between Peirce's sign definition and the relations defining an abstract automaton (Mealy, 1955). However, there is a basic limitation to the analogy proposed, and this limitation is that it refers to a clear cut definition of the sign within which classic set theory is applied. If we want to preserve the very foundation of the sign definition as laid down in Peirce's semiotic, we have to deal with the vagueness of the sign, a decision that Bense and his followers hesitated to make, not because they do not agree with the idea but because it was not theirs.

1. See J.S. Petofi 1976; R. Schank 1975, 1979; R. Schank and R.P. Abelson 1977; M. Minsky 1974.
2. Cf. M. Nadin 1981, l984. These semiotic operations were not only defined in theoretic terms, but also tested in various seminars and workshops focused on visual communication (graphic design, advertisement, photography, typography), architecture, product design, and in recent years on computer graphics and artificial intelligence.
3. In a manuscript dated November 1867, published in the *Writings of Charles Peirce. A Chronological Edition,* Vol. 2, 1984, under the title Specimen of a Dictionary of the Terms of Logic and Allied Sciences: A to ABS" (p. 105-122), Peirce covers abduction: "This is the English form of *abductio*, a word employed by Julius Pacius, as the translation of (*Prior Analytics,* lib. 2, cap. 25), which had been rendered *deductio* by Boethius and *reductio* and even *inductio* by the Schoolmen." He goes on to give Aristotle's definition and exemplifies it with "what can be taught," "science" and "justice." By abduction: "we come nearer to knowing that justice can be taught, on account of the credibility of justice being a science," (p. 108). The extreme at which abduction disappears is when instead of coming to something, we *know* it, i.e., when we deal with knowledge.
Among his writings concerning the subject: K.L. Ketner 1986, © with K.L. Ketner; 1984b; 1984a.
4. All these here in English translated quotations, cf. *Heraklitus* (ed. by Wheelwright 1964).
5. Cf. W.Z. Pylyshyn 1984, p. 147. The term "transducer" was adopted by the computer manufacturing community in search of better strategies for building parallel architecture machines when it had to deal with the relations between multiprocessors and the available memory, a distributional issue. As a matter of fact, a special language, named Occam, was devised for the same purpose. A more detailed account would go far beyond the scope of this study. The semiotic implications of such decisions cannot go unnoticed. In fact, we process signs of various origins and various qualities in parallel processing mode all the time.

Bibliography

Aristotle. *Analytica priora et posteriora. Recensuit brevique at notatione critica instruxit*, Ross, W.D. Oxford: Clarendon Press, l964.

Arwood, L.E. *Pragmaticism. Theory and Application.* Rockville: An Aspen Publication, 1983.

Bailey, R.W.; Matejka, L.; Steiner, P. (Eds.): *The Sign. Semiotics Around the World.* Ann Arbor: Michigan Slavic Publications, 1978.

Bar-Hillel, Y. Communication and argumentation in pragmatic languages, in *I linquaqqi nella societa e nella technica*. Milano: Comunita, 1970.

Bense, Max. *Zeichen und Design*. Baden-Baden: Agis Verlag, 1971.

Bense, M. Walther, E. *Worterbuch der Semiotik*. Koln: Kiepenheuer & Witsch, 1973.

Burkhardt, Hans. *Logik und Semiotik in der Philosophie von Leibniz*. Munchen: Philosophia Verlag, 1980.

Cassirer E. *Die Philosophie der symbolischen Formen*. (1923-1929) 3 Bde. Wissenschaftlicher Buchges., 1958/64.

Culler, J. *The Pursuit of Signs. Semiotics Literature, Deconstruction*. Ithaca: Cornell University Press, 1981.

Dewey, F. Peirce's theory of linguistic signs, thought, and meaning, in *Journal of Philosophy,* 43.4 1946 pp. 85-95.

Eco, U. *Semiotics and The Philosophy of Language.* Bloomington: Indiana University Press, 1984.

—. *Semantics, Pragmatics, and Text Semiotics.* MS, l985.

Findlay, J.N. *Meinong's Theory of Objects and Values*. Oxford: The Clarendon Press, 1963.

Fisch, M. Vico and Pragmatism, in*: Giambattista Vico: An International Symposium* (Ed. Giorgio Tagliacozzo, Hayden V. White). Baltimore: The Johns-Hopkins Press, l969, pp. 401-424.

Fisch, M. Peirce's general theory of signs, in *Sight, Sound and Sense* (Sebeok, T.A., Ed.), Bloomington: Indiana University Press, 1978, pp.31-70.

Freeman, E. (Ed.) *The Relevance of Charles Peirce*. LaSalle: The Monist, 1983.

Greimas, A.J., Courtes, J. *Sémiotique: dictionnaire raisonné de la theorie du langage.* Paris: Librairie Hachette, 1979.

Greimas, A.J.; Courtes, J. *Semiotics and Language. An Analytical Dictionary* (translated by Crist, Larry and Patte, Daniel, et al). Bloomington: Indiana University Press, 1982.

Heraclitus (Philip Wheelwright, Ed.): *Heraklitus*. New York: Atheneum, l964.

Ketner, K.L. The Early History of Computer Design: Charles Sanders Peirce and Marquand's Logical Machines, in *The Princeton University Library Chronicle,* 45 1984b, pp. 188-224.

—. Peirce on Diagrammatic Thought: Some Consequences for Contemporary Semiotic Science, in *Zeichen und Realität* (K. Oehler, Ed.). Tübingen: Stauffenburg Verlag 1984.

—. Peirce and Turing: Comparisons and Conjectures. MS (©1986, K.L. Ketner).

Kristeva, Y. *Semiotike. Recherches pour une Sémanalyse.* Paris: Seuil, 1969.

Kugel, P. Thinking may be more than computing, in *Cognition,* 22.2, (1985/1986), pp. 137-198.

Langer, S. K. *Philosophy in a New Key*. 3rd Ed. Cambridge: Harvard University Press, 1957.

Leibniz, G. W. *Neue Abhandlungen uber den menschlichen Verstand*. Frankfurt/Main: Insel Verlag, 1986.

—. *Die philosophischen Schriften*. Gerhard: Berlin, 1887-1890. Reprint: Hildesheim, 1965.

Lotman, J.M. *Kul'tura kak kollektivnyi intellekt i problemy iskusstvennogo razuma (Predvaritel'naja publikacija).* Moskva: Akademija Nauk SSSR (Nauchinyi sovet po kompleksnoi probleme kibernetika), 1977.

Lotman, J.M., Uspenskij, B.A. *The Semiotics of Russian Culture* (Ann Shukman, Ed.). Ann Arbor: Michigan Slavic Contributions, No. 11, l984.

Lyotard, J-F. *La Condition Postmoderne*. Paris: Minuit, 1979.

Marcus, S. *Gramatici si automate finite*. Bucuresti: Editura Academiei, 1964.

Mealy, G. A method of synthesizing sequential circuits, in *Bell Systems Technical Journal*, vol. 34 (1955), p. 1045.

Merrell, F. *Semiotic Foundations. Step toward an Epistemology of Written Texts.* Bloomington: Indiana University Press, 1982.

Miceli, S. *In nome del segno.* Palermo: Sellerio editore, 1982.

Minsky, M. A Framework for Representing Knowledge, in *The Psychology of Computer Vision),* (H. P. Winston, Ed.). New York: McGraw-Hill, 1975.

Morris, C. *Foundations of the Theory of Signs.* Chicago: University of Chicago Press, l938.

Nadin, M. Sign and Fuzzy Automata, in *Semiosis,* 5.1 (1977), 19-27.

—. The Logic of Vagueness and the Category of Synechism, in *The Monist,* 63.3 (1980). The article was later included in Freeman, E. (Ed.): *The Relevance of Charles Peirce*. LaSalle: The Monist, 1983, 351-353.

—. *Zeichen und Wert.* Tubingen: Gunter Narr, 1981.

—. The Civilization of Illiteracy, in *Semiotics l981* (Deely, J. and Lenhart, M., Eds.). New York: Plenum, 1983.

—. (Ed.) *The Semiotics of the Visual. On Defining the Field.* Special Issue of *Semiotica,* 52.3-4 (1984).

—. Pragmatics in the Semiotic Frame, in H. Stachowiak (Ed.) 1987, pp. 148-170.

—. *Mind—Anticipation and Chaos*. Stuttgart: Belser Presse, 1991.

—. *The Civilization of Illiteracy.* Dresden University Press, 1997.

Negoita, C.V., Ralescu, D.A. *Applications of Fuzzy Sets to Systems Analysis.* Basel: Birkhäuser Verlag, 1975.

Noth, W. *Handbuch der Semiotik.* Stuttgart: J.B. Metzlers Verlagsbuchhandlung, 1988.

Peirce, C.S. *The Collected Papers of Charles Sanders Peirce.* 8 volumes, Volumes 1-6: Hartshore, C.; Weiss, P. (Eds.). Volumes 7-8: Burks, A. (Ed.). Cambridge: The Belknap Press of Harvard University Press, 1931-1958.

—. *Writings of Charles S. Peirce. A Chronological Edition* (Moore, E., founding editor; Kloesel, C. Director, et al). Bloomington: Indiana University Press, 1982 (vol. 1) l984 (vol. 2), l986 (vol. 3).

—. Specimen of a Dictionary of the Terms of Logic and Allied Sciences: A to ABS, in *Writings of Charles Peirce. A Chronological Edition,* Vol. 2. Bloomington: Indiana University Press, l984, pp.105-122.

Pelc, J. "A Plea for Semiotics," *III. Congresso dell'associazone internazionale di studi semiotici,* Palermo, 25-29, June, 1984.

Petöfi, J.S. A Frame for Frames, in *Proceedings of the 2nd Annual Meeting-Berkeley Linguistic Society*. Berkeley: University of California at Berkeley, 1976, pp. 91-117.

Popper, K.R. Naturgesetze und theoretische Systeme, in *Theorie und Realitat* (Albert, H., Ed.). Tübingen: Mohr 1972, pp. 49ff.

Pylyshyn, W.Z. *Computation and Cognition. Toward a Foundation for Cognitive Science.* Cambridge MA/London: The MIT Press, 1984.

Rochberg-Halton, E., McMurtrey, K. The Foundations of Modern Semiotic: Charles Peirce and Charles Morris, in *American Journal of Semiotics*, 2.1-2(1983), pp. 129-156.

Rossi-Landi, F. *I Linguaggio come lavoro e come mercato,* Milan: Case Editrice Valentino Bompiani, 1968; American edition: *Language as Work and Trade*. South Hadley: Bergin & Garvey, 1983.

Schank, R. *Conceptual Information Processing.* Amsterdam: North-Holland, l975.

Schank, R., Abelson, R.P. *Scripts, Plans, Goals, and Understanding*. Hillsdale: Erblaum, 1977.

Sebeok, T. Umiker-Sebeok, J. (Eds.). *The Semiotic Sphere*. New York: Plenum Publishing Corp., 1985.

Stachowiak, H. (Ed.). *Pragmatik. Handbuch pragmatischen Denkens*. Bd. II: Der Aufsteig Pragmatischen Denkens im 19 und 20 Jahrhündert Hamburg: Felix Meiner Verlag, 1987.

Whitehead, N. *Symbolism: Its Meanings and Effects*. New York: MacMillan, 1958.

Zadeh, L. Fuzzy Sets. *Information and Control*, 8 (1965), pp. 338-353.

—. Fuzzy Logic and Approximate Reasoning (In memory of Grigore Moisil), in *Synthese* 30 (1975), pp. 407-428.

—. PRUF - A Language for the representation of meaning in natural languages, in *International Joint Conference on Artificial Intelligence (JCAI) Proceedings,* Vol. II; Cambridge: MIT Press, 1977, p. 918.

—. Fuzzy sets as a basis for a theory of possibility, in *ERL Memo* M77/12, 1977.